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None

(58) Field of search
UK CL (Edition J) F2T
INT CL⁴ F16F

(54) Fly-wheel

(57) A fly-wheel wherein a synthetic resin pulley and a metal disk are maintained in a firmly coupled condition without requiring a high degree of accuracy in dimension and without the necessity of employing such means as adhesion. The pulley 11 has a cylindrical portion 14 and three or more supporting pieces 15, 16 formed therein while a cylindrical portion passing hole (17) and three or more supporting piece passing openings 18 are formed in the metal disk 12. Two or more of the supporting pieces 15, 16 are bifurcated, and the metal disk 12 further has a plurality of engaging holes 19 formed therein corresponding to the bifurcated supporting pieces 16. The opposite side edges 20 of the bifurcated supporting pieces 16 or the opposite edge portions 21 of the engaging holes 19 have inclined faces (22a, 22b; 25) formed thereon for causing, when they are resiliently contacted with each other, components of force of the contacting pressure of the resilient contact to be exerted simultaneously in a circumferential direction and an axial direction.

FIG. 1

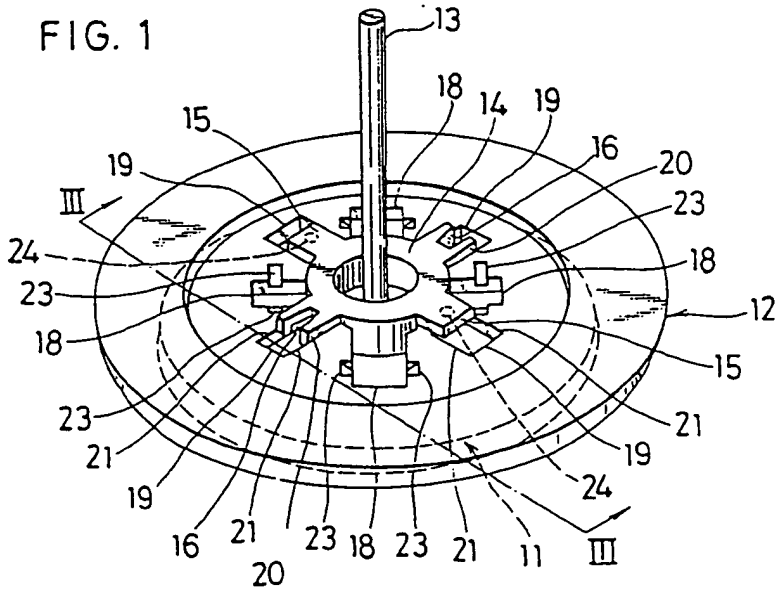

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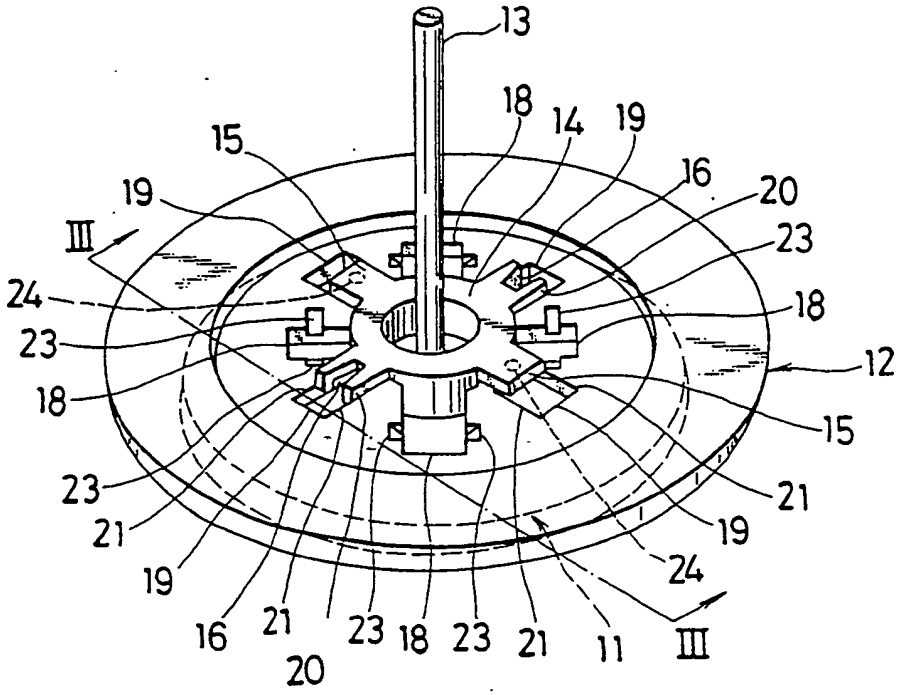
FIG. 1


13
18
14
19
15
16
20
19
III
23
24
18
23
12
18
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16
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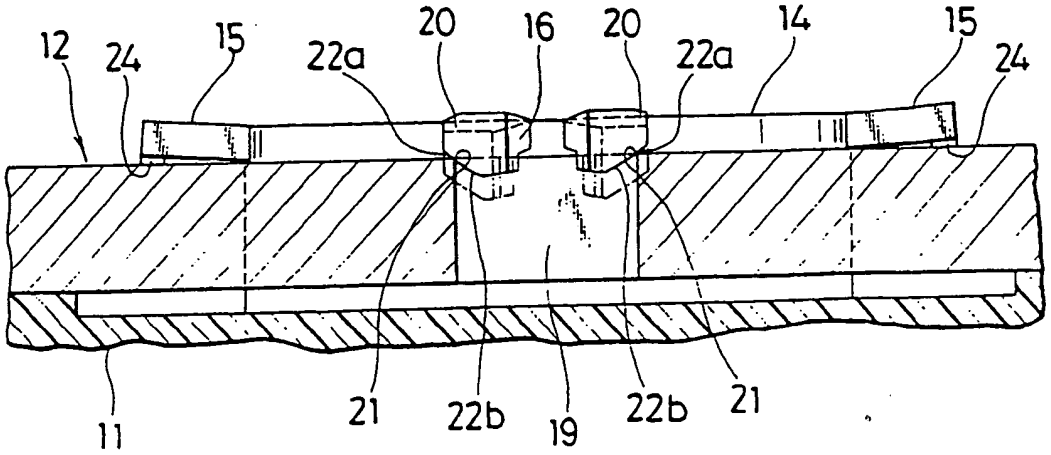
23
18
23
21
11
III
20

FIG. 3


12
24
15
22a
20
16
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22a
14
15
24
11
21
22b
19
22b
21

FIG. 2

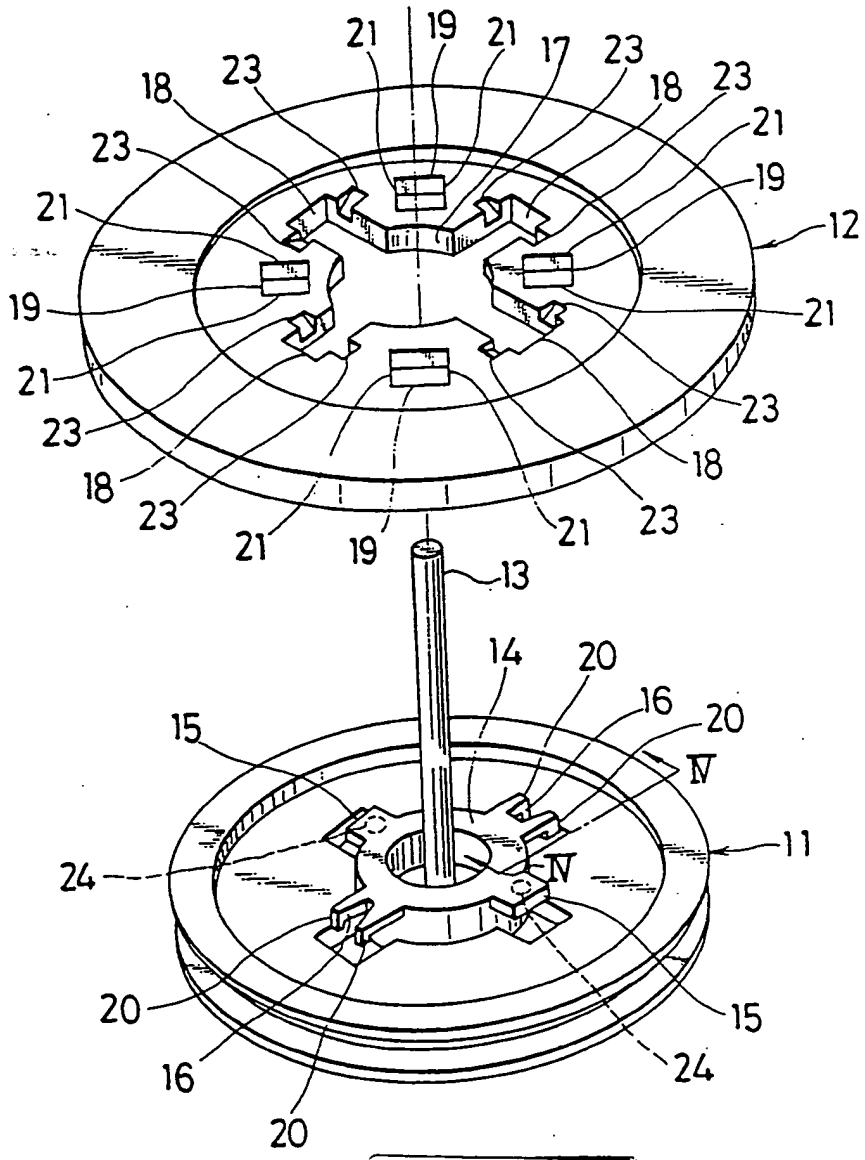


FIG. 4

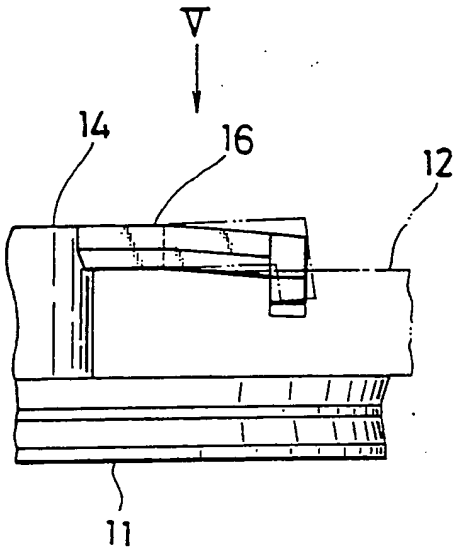


FIG. 5

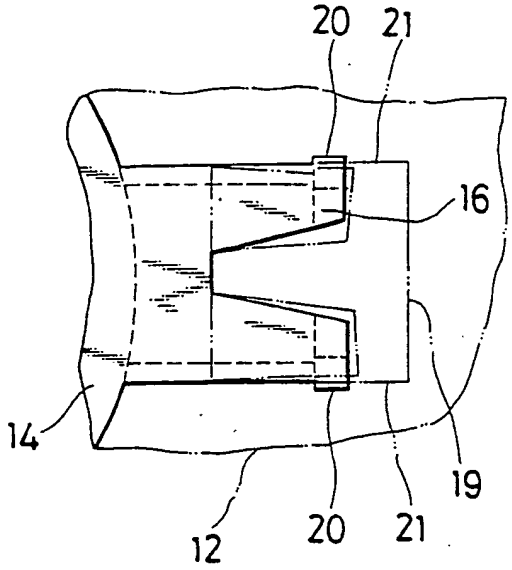


FIG. 6

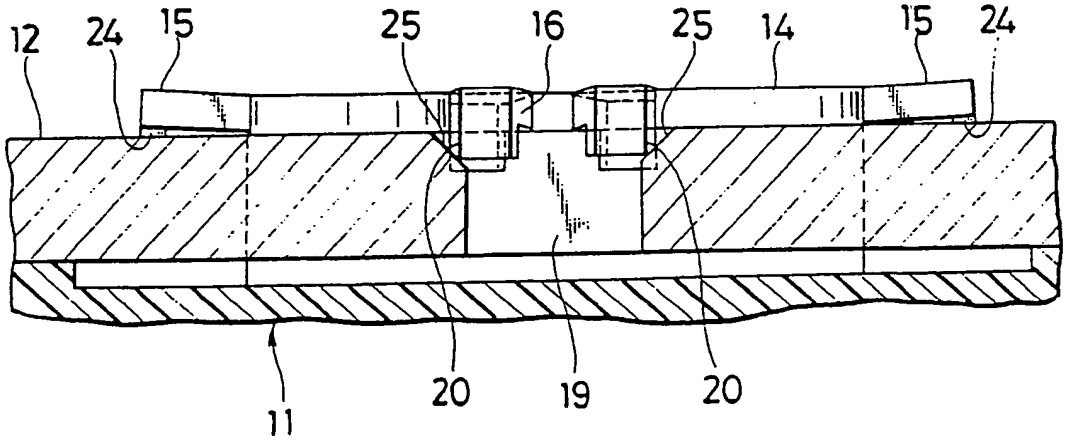
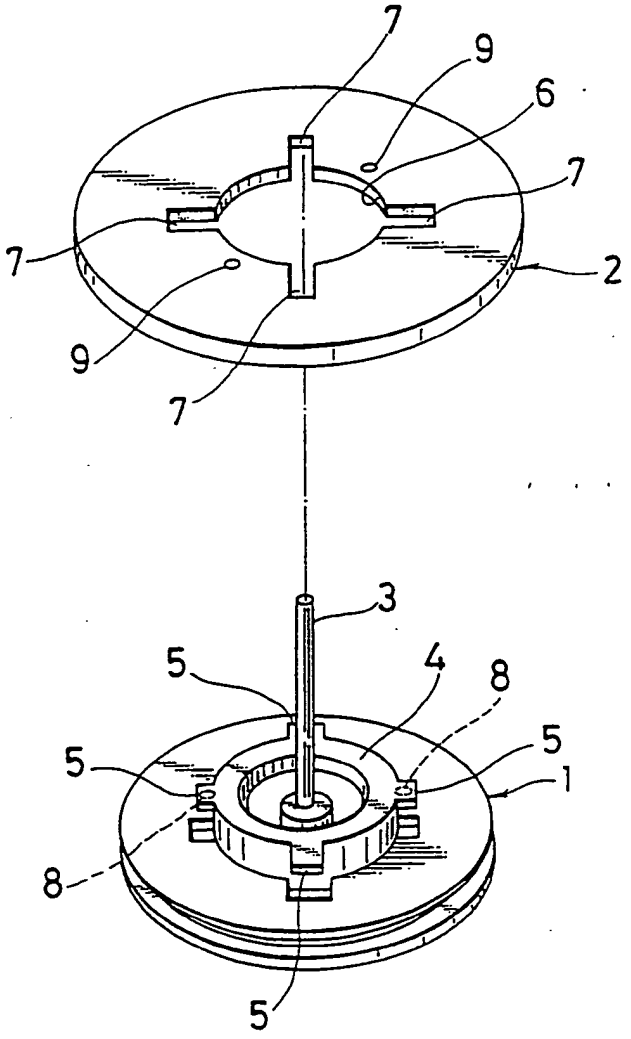


FIG. 7



FLY-WHEEL

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates to a fly-wheel wherein a pulley made of a synthetic resin and a disk made of a metal are integrated with each other, and more particularly to improvements in or relating to a fly-wheel wherein a synthetic resin pulley and a metal disk are firmly coupled to each other making use of resilient force of a supporting piece provided on the pulley.

2) Description of the Prior Art

Such a fly-wheel as shown in FIG. 7 is already known and disclosed in Formosan Patent Publication No. 83743.

The fly-wheel shown in FIG. 7 is used, for example, for a capstan of a tape recorder and includes a pulley 1 made of a synthetic resin, and a disk 2 formed from a metal by press work and integrated with the pulley 1. A shaft 3 serving as a capstan shaft is force fitted in a center bore (not shown) of the pulley 1. A cylindrical portion 4 is provided in such a configuration on the pulley 1 that it may surround a base portion of the shaft 3, and it has four supporting

pieces 5 in the form of radial projections provided at circumferentially equal intervals on an outer periphery thereof. A cylindrical portion fitting hole 6 is perforated at the center of the metal disk 2, and four supporting piece passing openings 7 are formed at circumferentially equal intervals in the metal disk 2 in a contiguous relationship to the cylindrical portion fitting hole 6. The cylindrical portion 4 of the pulley 1 can be fitted into the cylindrical portion fitting hole 6 of the metal disk 2 while the supporting pieces 6 of the pulley 1 can be passed through the supporting piece passing openings 7 of the metal disk 2.

In integrating the pulley 1 and the metal disk 2 with each other, at first the metal disk 2 is manually operated to move axially downwardly passing the supporting pieces 5 of the cylindrical portion 4 of the pulley 1 through the corresponding supporting piece passing openings 7 of the metal disk 2 until it comes to a position just below the supporting pieces 5 and is received by an upper face of the pulley 1. Then, the pulley 1 is rotated relative to the metal disk 2 whereupon a pair of small projections 8 provided on lower faces in FIG. 7 of a pair of opposing ones of the supporting pieces 5 slide on an upper face of the metal disk 2 under a resilient force exerted by the supporting

pieces 5 of the pulley 1 and inner sectoral portions of the metal disk 2 defined by the supporting piece passing openings 7. When the metal disk 2 is rotated until the small projections 8 are registered with a pair of circular small holes 9 perforated in the metal disk 2, the small projections 8 are fitted into the small holes 9 by the resilient force described above. Consequently, the pulley 1 and the metal disk 2 are thereafter prevented from rotating relative to each other, thereby completing the integrating operation of the two members 1 and 2.

With such a conventional fly-wheel as shown in FIG. 7, the small projections 8 provided on the reverse faces of the two supporting pieces 5 and the circular small holes 9 provided in the metal disk 2 are fitted with each other to prevent rotation of the pulley 1 and the metal disk plate 2 relative to each other. Accordingly, the positional relationship between the small projections 8 and the small holes 9 must be set with a high degree of accuracy, and as a result, there is a problem that a high degree of accuracy in dimension is required for both of the pulley 1 and the metal disk 2. Besides, since the small projections 8 and the small holes 9 are held in a mere fitting relationship with each other, the force to restrict rotation of the pulley

1 and the metal disk 2 relative to each other and the force to contact the pulley 1 and the metal disk 2 closely with each other in their axial direction are not sufficiently high. In addition, the coupling force between the pulley 1 and the metal disk 2 will be reduced further if the fly-wheel undergoes a temperature environmental test because the test periodically exposes the fly-wheel to temperature changes from a high and to a low temperature and vice versa. To compensate for the reduced coupling force, it is necessary to employ such means as to adhere the two members to each other by means of a bonding agent.

SUMMARY OF THE INVENTION

It is an object of the present invention provide a fly-wheel wherein a pulley made of a synthetic resin and a disk formed from a metal by press work and integrated with the pulley are maintained in a firmly coupled condition without requiring a high degree of accuracy in dimension and without the necessity of employing such means as adhesion.

In order to attain the object, according to the present invention, there is provided a fly-wheel wherein a synthetic resin pulley and a metal disk formed by press work are integrated with each other with a shaft

force fitted in a center portion of the pulley, and the pulley has a cylindrical portion provided thereon in such a configuration that it may surround a base portion of the shaft and further has three or more supporting pieces formed at equal intervals in a circumferential direction on an outer periphery of an end portion of the cylindrical portion such that they may extend in radial directions while a cylindrical portion passing hole through which the cylindrical portion of the pulley can pass and three or more supporting piece passing openings through which the supporting pieces of the pulley can pass are formed in a contiguous relationship in the metal disk, whereby the pulley and the metal disk are integrated with each other by passing the three or more supporting pieces of the pulley through individually opposing ones of the supporting piece passing openings of the metal disk and rotating the pulley by a predetermined angle relative to the metal disk, characterized in that each of two or more of the supporting pieces has a bifurcated configuration while the metal disk has a plurality of engaging holes formed therein in a corresponding relationship to the bifurcated supporting pieces between the supporting piece passing openings such that the opposite side edge portions of each of the bifurcated supporting pieces may

be resiliently contacted with the opposite edge portions of a corresponding one of the engaging holes, and at least one of each of the opposite side edge portions of each of the bifurcated supporting pieces and each of the opposite side edge portions has an inclined face formed thereon for causing components of force of a contacting pressure of the resilient contact to be exerted simultaneously in a circumferential direction and an axial direction of the shaft.

With the fly-wheel, a contacting pressure between each of the bifurcated supporting pieces and one of the opposite edge portions of the engaging holes which is contacted with the bifurcated supporting piece has components of force acting in a circumferential direction and an axial direction of the shaft due to the inclined faces provided on the opposite side edges of the bifurcated supporting pieces or the opposite edge portions of the engaging holes. Such components of force assure maintenance of a firmly coupled condition between the synthetic resin pulley and the metal disk, and the firmly coupled condition can be maintained even after the fly-wheel undergoes a severe temperature environmental test. Besides, such a high degree of accuracy in dimension as required in a conventional fly-wheel is not required.

Preferably, each of the inclined faces consists of a first portion having a predetermined inclination angle with respect to a plane perpendicular to the shaft, and a second portion formed in a contiguous relationship to the first portion and having another predetermined inclination angle smaller than the predetermined inclination angle of the first portion so that, when the pulley is rotated relative to the metal disk in order to assemble the former to the latter until the bifurcated supporting pieces come to the positions of the engaging holes, the bifurcated supporting pieces may be positioned rapidly and automatically with respect to the engaging holes due to a synergetic effect of the resilience of the bifurcated supporting pieces and the second portions of the inclined faces.

A specific embodiment of the present invention will now be described in detail by way of example with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a fly-wheel in an assembled condition showing a preferred embodiment of the present invention;

FIG. 2 is a fragmentary perspective view of the fly-wheel shown in FIG. 1;

FIG. 3 is a partial sectional view, in an enlarged scale, taken along line III-III of FIG. 1;

FIG. 4 is a partial sectional view, in a similarly enlarged scale, taken along line IV-IV of FIG. 2;

FIG. 5 is a view as viewed in the direction indicated by an arrow mark V in FIG. 4;

FIG. 6 is a view similar to FIG. 3 but showing a fly-wheel according another embodiment of the present invention; and

FIG. 7 is a fragmentary perspective view showing a conventional fly-wheel.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring first to FIGS. 1 to 5, there is shown a fly-wheel according to a preferred embodiment of the present invention. The fly-wheel shown includes a pulley 11 made of a synthetic resin, and a disk 12 formed from a metal by press work and integrated with the pulley 11. A shaft 13 which may serve as a capstan shaft is force fitted in a center bore (not shown) of the pulley 11. The pulley 11 has a cylindrical portion 14 formed in such a configuration thereon that it may surround a base portion of the shaft 13. The pulley 11 further has a pair of supporting pieces 15 in the form

of flat plates or tongues and a pair of bifurcated supporting pieces 16 formed alternately at circumferentially equal intervals of 90 degrees on an outer periphery of an upper end portion of the cylindrical portion 14 such that they may extend in radial directions. Meanwhile, a cylindrical portion fitting hole 17 is perforated at the center of the metal disk 12, and four supporting piece passing openings 18 are formed at circumferentially equal intervals in the metal disk 12 in a contiguous relationship to the cylindrical portion fitting hole 17. The cylindrical portion 14 of the pulley 11 can be fitted in the cylindrical portion fitting hole 17 of the metal disk 12 while the supporting pieces 15 and 16 of the pulley 11 can be passed through the supporting piece passing openings 18 of the metal disk 12.

The metal disk 12 further has four engaging holes 19 formed in the metal disk 12 between the supporting piece passing openings 18. Each of the engaging holes 19 has a rectangular configuration corresponding to the bifurcated supporting pieces 16 of the cylindrical portion 14 of the pulley 11. A pair of small lower projections 20 are provided at two outer radial ends of each of the bifurcated supporting pieces 16 and are adapted to resiliently contact with a pair of

circumferential edges 21 of one of the engaging holes 19 as seen in FIG. 3 to prevent further rotation of the pulley 11 and the metal disk 12 relative to each other.

As particularly seen in FIG. 3, each of the bifurcated small projections 20 of the supporting pieces 16 has two different but contiguous inclined faces 22a and 22b formed thereon. The outer or upper inclined face 22a is formed adjacent a circumferential side face of the bifurcated supporting piece 16 and has an inclination angle of 70 to 75 degrees with respect to a plane perpendicular to the shaft 13 while the inner or lower inclined face 22b is formed in a contiguous relationship to the upper inclined face 22a and has an inclination angle of about 45 degrees. When the pulley 11 and the metal disk 12 are in such an assembled condition as seen in FIG. 1, the upper inclined faces 22a of each of the bifurcated small projections 16 are held in pressure contact with the circumferential edges 21 of an engaging hole 19.

A pair of inclined recessed faces 23 are formed on the metal disk 12 adjacent the circumferentially opposite walls of each of the supporting piece passing openings 18. Each of the inclined recessed faces 23 is inclined in a circumferential direction at an inclination angle of about 45 degrees with respect to

the plane perpendicular to the shaft 13.

In integrating the synthetic resin pulley 11 and the metal disk 12 individually having such constructions as described hereinabove with each other, at first the metal disk 12 is manually operated to move axially downwardly passing the supporting pieces 15 and 16 of the pulley 11 through the supporting piece passing openings 17 and fitting the cylindrical portion 14 of the pulley 11 into the cylindrical portion fitting hole 17 of the metal disk 12. Then, after the metal disk 12 is received on an upper face of the pulley 11 as seen in FIG. 3, the pulley 11 is rotated relative to the metal disk 12. Upon such rotation of the pulley 11, the supporting pieces 15 and 16 are guided by the inclined recessed faces 23 of the metal disk 12 to escape from the supporting piece passing openings 18 while being resiliently deformed in upward directions. Consequently, lower end faces of the small projections 24 of the flat plate-formed supporting pieces 15 and the end lower projections 20 of the bifurcated supporting pieces 16 are now resiliently contacted with the upper flat face of the metal disk 12. As the pulley 11 is further rotated relative to the metal disk 12 over an angle of about 45 degrees, the end lower projections 20 of the bifurcated supporting pieces 16 are resiliently

snapped into two diametrically opposing ones of the engaging holes 19 so that the upper inclined faces 22a are resiliently contacted with the opposite circumferential edges 21 of the two engaging holes 19 as particularly seen in FIG. 3, thereby completing the integrating operation of the synthetic resin pulley 11 and the metal disk 12.

In such an integrated condition of the pulley 11 and the metal disk 12, the bifurcated supporting pieces 16 of the cylindrical portion 14 of the pulley 11 are held in a condition resiliently deformed a little in upward directions as shown by solid lines in FIG. 3 and by two-dot chain lines in FIG. 4 and also resiliently deformed in circumferential directions such that the bifurcated ends thereof may approach each other a little as shown by two-dot chain lines in FIG. 5. Besides, as the inclined faces 22a of the bifurcated supporting pieces 16 are held in resilient contact with the circumferentially opposite edges 21 of the engaging holes 19 of the metal disk 12, the resilient contacting force between them is divided into a component of force in a circumferential direction and a component of force in an axial direction. The former component of force will prevent the pulley 11 and the metal disk 12 from rotating relative to each other around the common axis

while the latter component of force will strongly urge them to closely contact with each other in an axial direction.

In addition, since also the flat plate-formed supporting pieces 15 are resiliently deformed a little in upward directions as shown in FIG. 3 and the small projections 24 provided at the ends thereof are contacted under a resilient pressing force with the upper face of the metal disk 12, the pulley 11 and the metal disk 12 are closely contacted further strongly in the axial direction with each other.

It is to be noted that the specific construction that the two different but contiguous inclined faces 22a and 22b are provided at the outer radial ends of the bifurcated supporting pieces 16 and the inclination angle particularly of the lower inclined faces 22b is made moderate is employed in order to attain a particular function. In particular, when the pulley 11 and the metal disk 12 are to be assembled, only if they are rotated relative to each other until the bifurcated supporting pieces 16 come to the positions of the engaging holes 19, the bifurcated supporting pieces 16 may be positioned rapidly and automatically with respect to the engaging holes 19 due to a synergetic effect of the resilience of the bifurcated supporting pieces 16

and the inclined faces 22b.

Accordingly, with the construction described above, the pulley 11 and the metal disk 12 can be coupled firmly to each other without employing such an additional means as adhesion. Further, they can sufficiently bear a severe temperature environmental test wherein a high temperature and a low temperature are periodically and successively repeated. Accordingly, a very good effect for practical use can be attained.

Incidentally, eighteen fly-wheels having the same construction as that of the embodiment described above were experimentally produced, and a temperature environmental test was conducted for 24 x 8 hours wherein they were left in temperature environments of +85 °C to -20 °C each for 24 hours. Even after such a severe temperature environmental test, however, the coupled condition between the pulley 11 and the metal disk 12 were maintained to a satisfactory degree.

It is to be noted that, while in the embodiment described above the inclined faces 22a and 22b are formed on the circumferentially opposite side portions of each of the bifurcated supporting pieces 16 of the pulley 11, they may be provided otherwise on the circumferentially opposite edges 21 of the engaging

holes 19 or else on both of the bifurcated supporting pieces 16 and the circumferentially opposite edges 21 which are to contact with each other.

Referring to FIG. 6, the former modification is shown. In the modification shown, a pair of inclined faces 25 are provided not on bifurcated supporting pieces 16 but on the circumferentially opposite edge portions of each of engaging holes 29. Also with the construction, similar effects to those of the embodiment of FIGS. 1 to 5 can be attained.

While in each of the embodiments described above the supporting pieces 15 and 16 and the engaging holes 19 are provided each by four, they may be provided each by three or more.

Meanwhile, the bifurcated supporting pieces 16 should be provided by two or more.

CLAIMS:

1. A fly-wheel wherein a synthetic resin pulley and a metal disk formed by press work are integrated with each other with a shaft force fitted in a center portion of said pulley, and said pulley has a cylindrical portion provided thereon in such a configuration that it may surround a base portion of said shaft and further has three or more supporting pieces formed at equal intervals in a circumferential direction on an outer periphery of an end portion of said cylindrical portion such that they may extend in radial directions while a cylindrical portion passing hole through which said cylindrical portion of said pulley can pass and three or more supporting piece passing openings through which said supporting pieces of said pulley can pass are formed in a contiguous relationship in said metal disk, whereby said pulley and said metal disk are integrated with each other by passing said three or more supporting pieces of said pulley through individually opposing ones of said supporting piece passing openings of said metal disk and rotating said pulley by a predetermined angle relative to said metal disk, and in which

each of two or more of said supporting pieces

has a bifurcated configuration while said metal disk has a plurality of engaging holes formed therein in a corresponding relationship to the bifurcated supporting pieces between said supporting piece passing openings such that the opposite side edge portions of each of the bifurcated supporting pieces may be resiliently contacted with the opposite edge portions of a corresponding one of said engaging holes, and at least one of each of the opposite side edge portions of each of the bifurcated supporting pieces and each of the opposite side edge portions has an inclined face formed thereon for causing components of force of a contacting pressure of the resilient contact to be exerted simultaneously in a circumferential direction and an axial direction of said shaft.

2. A fly-wheel as set forth in claim 1, wherein each of the inclined faces consists of a first portion having a predetermined inclination angle with respect to a plane perpendicular to said shaft, and a second portion formed in a contiguous relationship to said first portion and having another predetermined inclination angle smaller than said predetermined inclination angle of said first portion so that, when said pulley is rotated relative to said metal

disk in order to assemble the former to the latter until said bifurcated supporting pieces come to the positions of said engaging holes, said bifurcated supporting pieces may be positioned rapidly and automatically with respect to said engaging holes due to a synergetic effect of the resilience of said bifurcated supporting pieces and said second portions of said inclined faces.

3. A fly-wheel substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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